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GARBAGE TO GOLD? ISSUES AND OPPORTUNITIES

Terms of Reference and Background Information

Alberta
ENVIRONMENT COUNCIL OF ALBERTA

DDN 6298237

Terms of Reference

FOR PUBLIC HEARINGS ON THE RECYCLING OF WASTE WITHIN THE PROVINCE OF ALBERTA

The Environment Council of Alberta is hereby requested to:

1) Enquire into the potential for the economic recycling of products presently disposed of as wastes; giving particular attention to:

   a) the potential, scope and obstacles to increased recycling by private sector business enterprises;

   b) the potential, scope and obstacles to increased recycling by volunteer organizations;

   c) the support role of local governments and the provincial government in facilitating recycling by the private sector and volunteer organizations, considering the potential reduction in waste disposal costs, the enhancement of the environment and privatization.

2) Consider the potential and comparative economics of the generation of energy from wastes when the alternative of the creation of useful goods and services from wastes is not feasible.

3) Hold public hearings at suitable locations throughout the province, and report to the Minister of Environment and the Lieutenant-Governor in Council on completion of the report.

— Order In Council 106/85

GARBAGE TO GOLD? ISSUES AND OPPORTUNITIES TERMS OF REFERENCE AND BACKGROUND INFORMATION

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December 1985

Distributed without charge as a public service.

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Preface

The Government of Alberta has asked the Environment Council of Alberta to enquire into the potential for the economic recycling of products presently disposed of as wastes and to consider the potential and comparative economics of the generation of energy from wastes when alternative recycling routes are not feasible. Following the enquiry and its public hearings the Environment Council will submit a report and recommendations to the Minister of Environment and the Lieutenant-Governor in Council.

As part of its preparation for the hearings the Environment Council has prepared a series of reports on various aspects of recycling. These reports are intended to provide background information, to highlight issues that are likely to be important to the Council's enquiry and public hearings, and to stimulate comment and suggestions from the public to the hearings. The reports are not intended to provide answers to all concerns about recycling, nor to make recommendations. These will be developed by the Public Hearing Panel in its Report and Recommendations following the public hearings.

This report draws on information from the other reports and raises some of the issues which must be considered during development of a recycling plan for Alberta.

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PUBLIC HEARINGS ON THE RECYCLING OF WASTE IN ALBERTA

The Environment Council of Alberta has been asked by the provincial government to enquire into the recycling of waste in Alberta and to hold public hearings on the topic. The terms of reference for the hearings are printed on the inside of the front cover. The government is seeking advice on both the feasibility and means of increasing recycling. The use of waste as fuel in energy-from-waste facilities, where other alternatives are not feasible, is also to be considered.

BACKGROUND INFORMATION

ENVIRONMENT COUNCIL BROCHURES

To assist you in the preparation of submissions to the hearings the Environment Council has prepared two brochures: "Environment Council of Alberta" and "Public Hearings". The first brochure describes the organization, role, functions and achievements of the Environment Council of Alberta. The second outlines the organization of Environment Council public hearings and how you may participate. The two brochures are contained in a pocket on the back cover of this report. Additional copies may be obtained from the Environment Council.

VIDEO-TAPE

The Environment Council of Alberta also has available for loan a video-tape called *One Man's Garbage, Another Man's Gold?* This 15 minute videotape provides an overview of recycling in Alberta and discussion of some future options. It may be borrowed in a variety of tape sizes from the Environment Council Library.

BACKGROUND REPORTS

In addition to this report, a series of reports has been prepared that provide information on recycling or the use of waste as fuel. These reports are described below and the titles are listed in Appendix 1. The reports are available without charge from the Environment Council.

The Use of Municipal Waste as Fuel

Municipal solid waste has potential as a fuel for the production of energy in the form of heat or electricity. This report, prepared in 1983, reviews literature related to the use of municipal waste as a fuel for power generation and discusses some of the options that involve separation and processing of usable elements in the waste. The report also discusses some issues related to landfilling versus energy and resource recovery options.

Economic Barriers to Recycling

This report discusses some of the environmental advantages to recycling in the context of the flow of materials through the economy, and describes some economic obstacles to recycling and to increasing the supply of and demand for recycled products. Policy options included are: buffer stocks schemes, guaranteed prices, futures markets, charges for waste disposal, virgin materials tax, product charge taxes, deposit-refund systems, and procurement policies.

Municipal Solid Waste - Alberta's Untapped Resource?

About 1.8 million tonnes of municipal solid waste are discarded each year in Alberta. This report answers questions about: What is the composition of this waste? How is it collected, transported and disposed of? What waste treatment practices are available to handle this waste and what might be done in the future?

Resource Recycling in Alberta

Thousands of tonnes of metals, rubber, glass, lubricating oil, plastic and paper are used annually in Alberta. Some of this material is recovered and reused but much is discarded. This report discusses the amounts of these materials used and recycled, and some of the opportunities and constraints affecting recycling rates.

A Social Perspective of Recycling in Alberta

This report examines recycling from a social perspective. What is the role of public attitudes and personal motivation? What are some of the social costs and benefits of recycling? The report also describes the involvement of individuals and groups in recycling activities such as drives, depots, curbside collection, and mixed collection.

Legislation, Policies, and Programs Affecting Recycling in Alberta

This report, prepared by Alberta Environment, describes and discusses legislation, policies, and programs in Alberta that affect recycling. Included are: reviews of the Beverage Container Act, the Oil Drop Program, Alberta Environment's Municipal Resource Recovery Program for assisting local recycling efforts, and the Alberta Waste Materials Exchange.

Bibliography of Recycling

A bibliography of reference material used in researching and writing the background reports has been prepared. While the bibliography is not a complete listing of information resources, it provides a starting point covering further information.

This series of background reports is intended to assist you in preparing a submission to the hearings, but it is your comments that are most important. Input from local governments, industry, volunteer organizations, and interested persons is required in order for the Panel to provide Government with the best possible advice. This information may be data on present recycling activities or waste generation, views on the problems facing recycling, ideas for improving present programs, or suggestions for innovative ways to create recycling opportunities. Certainly, the available information indicates that Alberta already achieves a significant level of recycling, but there is room for substantial improvement. The challenge facing the Environment Council is to identify the potential for recycling and the best approachs to achieve this potential.

Input will be received at public hearings throughout the province. Submissions may be written or oral. For further information concerning dates and locations for the hearings or to request reports contact:

Environment Council of Alberta
8th Floor, Weber Centre
5555 Calgary Trail Southbound
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In Edmonton call 427 5792. Out of town call the operator and ask for Zenith 06075.

WHAT A WASTE!

Accurate data on the amount and composition of material landfilled in Alberta are not available. Waste generation rates and composition are affected by community size, convenience and cost of collection, available alternative disposal methods, recycling, affluence of the individual or business, seasonal variations in waste generation, and the amount and type of industrial or commercial activity. As well, longer term influences such

Each Albertan discards about 0.8 tonnes of waste every year.

Table 1. Estimated Amount and Composition of Waste Landfilled in Alberta

Material	Average Composition (%) *	Total Amount Generated (tonnes)
Total	99.99	1,800,000
Paper	32.27	581,000
Glass	5.19	93,400
Metal	6.05	108,900
Plastic	4.71	84,800
Textiles, Leather, Rubber	3.11	56,000
Wood	4.67	84,100
Putrescible	33.41	601,000
Yard Waste	8.05	145,000
Other	2.53	45,500

Assumptions:

	Population (1984)	Waste Generation Rate tonnes/capita/year
Calgary and Edmonton	1,179,899	0.902
Other cities > 10,000	315,839	0.689
Small communities and rural areas	853,062	0.617
Alberta	2,348,800	0.766

*Composition information from Bird and Hale Ltd., Clarke, Derzko and Associates Ltd., and L.S. Love and Associates (Canada) Ltd. 1979. Municipal Refuse Statistics for Canadian Communities of over 100,000 (1976-1977). EPS 3-EC-79-9. Environmental Protection Service, Environment Canada. Ottawa.

as technological changes, changing consumer buying patterns and marketing of new products such as microwave usable food containers affect the amount of waste and its composition. Waste generation rates and composition are rough estimates and subject to change. Improvement in the information base is essential to improved decision making.

Available estimates of disposal rates for a number of communities and regional landfills are based on the amount of material delivered to the landfill. An estimated average disposal rate for Alberta is about 0.8 tonnes per capita per year (Table 1). This amount does not include construction or demolition rubble. However, disposal rates characteristically have great variability. The composition of the waste stream is also difficult to determine. In spite of the problems and potential error sources, an estimate of the amount and composition of waste generated in Alberta is an essential starting point. Table 1 indicates the amount of material that is landfilled. Removing the material that can be recycled reduces the volume landfilled.

The costs of waste disposal in 1984 ranged from $40.30 per tonne to $55.29 per tonne for the major municipalities. These costs include collection, transfer station operation (Edmonton only) and landfilling. Based on the amount of waste calculated for Table 1 and an average cost for waste disposal in the five major municipalities of $48 per tonne, approximately $86,000,000 was spent on waste disposal in Alberta in 1984.

Municipal taxes are levied for waste disposal services to residents. Commercial and industrial waste generators often have their wastes removed by a private hauler at the generator's expense. Part of a municipality's operating costs may be recovered through tipping charges for wastes from commercial outlets, construction sites, and neighboring communities.

Several communities in Alberta are investigating incineration of refuse as an alternative to landfills. The economics of incineration often make it a more expensive alternative, but when factors such as the social and environmental costs are included, incineration may appear viable. The recovery of energy during incineration offers the possibility of some return on the investment. Another alternative to direct recovery of energy is the production and sale of refuse-derived fuel to other users. The feasibility of such options depends on the local situation, waste composition and amounts, local energy needs and future markets as well as the recovery of other resources from the waste stream.

Energy content is an important characteristic for the use of municipal solid waste in energy-from-waste facilities or in the production of refuse-derived fuel. The energy content of mixed refuse is roughly equivalent to that of the plains coal used in the thermal power plants in Alberta.

Often there is perceived to be a conflict between recycling paper fibre and its use as a fuel. Although paper is a substantial fraction of the waste stream, the average energy value of the waste may not be substantially reduced by its removal since the energy content of paper is comparable to that of the mixed waste. Removal of paper however, affects the total amount of waste available. Removal of other, non-combustible, materials likely enhances the energy content of the waste. Appropriate sizing of a facility to account for recycling should be considered in the same manner as other changes in the amount of waste.

INTEGRATING RECYCLING AND WASTE MANAGEMENT

Recycling should not be seen as an isolated activity. The benefits of incorporating recycling as part of a fully integrated waste management plan include improved efficiency of materials use and, as a result, a reduced product cost. Consideration of waste volumes, disposal costs, and alternatives to waste disposal during product design can improve the potential for materials recovery. For example, separation and reuse of materials from bimetallic containers is more difficult than reuse of single material containers. The reuse of materials in laminated containers is impractical.

Minimizing waste within the production process reduces raw material requirements, which reduces costs. Minimizing waste production lowers waste disposal costs and increases the competitive advantage of the final product. The value of scrap should be maximized by keeping suitable scrap clean and separate, thereby facilitating its reuse in the plant, or sale to another industry. The recovery of reusable materials from mixed or contaminated municipal wastes is markedly more difficult than the reuse of materials which have been kept segregated and clean.

Municipalities also benefit from integrating recycling into their waste management operations. Landfill space can be conserved through a comprehensive waste management plan that includes recycling. Reduced landfilling saves money while offering environmental and social benefits.

Although materials management and waste reduction is an integral part of the planning process in some industries, it is not so for all industries. Why is this? Are raw materials so abundant and inexpensive that it is less costly to use virgin materials and pay the disposal costs than to reduce waste? Or are raw materials and waste disposal options undervalued because they do not reflect all of the costs of materials extraction and waste disposal?

WHY RECYCLE?

Recycling occurs in a myriad of forms from the reuse of jam jars to the use of newspapers in roofing felt. Recycling also occurs for a myriad of reasons. The following discussion is intended to highlight some common reasons for recycling.

Improved Efficiency of Resource Use

The reuse of materials often is seen as improving the efficiency of resource use and hence assisting with conservation of our natural resources. All resources are finite and their prudent use is required. The concept of "spaceship earth" emphasizes that there is a limited amount of space and resources to be used by all. Other events highlighting the concept include the "energy crisis" and predictions of shortages for some metals. While conservation of resources has more immediacy for non-renewable resources, concerns also exist about our ability to manage properly renewable resources to supply our growing demands.

Recycling conserves resources.

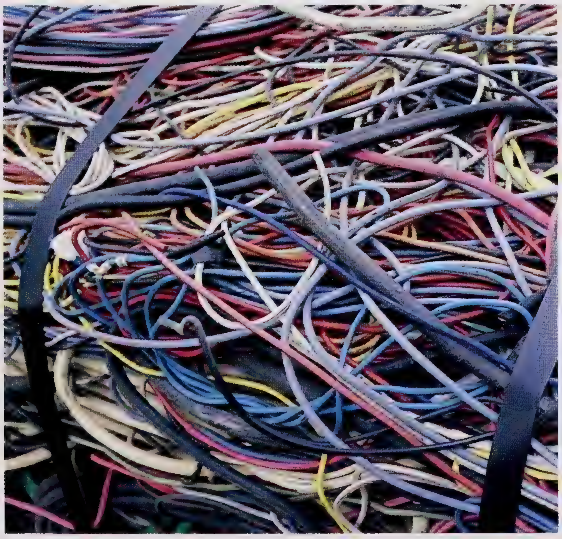
Conservation of Energy

The reuse of previously processed materials is generally perceived to require less energy than manufacturing products from virgin materials. Energy also may be recovered through incineration and heat recovery or generation of electricity, or the production of combustible products through pyrolysis. Thus recycling or the recovery of energy can reduce overall energy needs.

Reduction in Waste Volumes

Any reduction in the amount of material landfilled increases the life expectancy of the landfill and postpones the difficult task of siting a new landfill.

The direct costs of collecting and landfilling waste are only a portion of the total costs of waste disposal. There are replacement costs to consider and land acquisition may be a substantial part of new site development costs. In addition, access to the site may need to be constructed or upgraded. There also are reclamation costs following landfill closure. Since there are only a limited range of uses for old landfills the reduced opportunity for revenue generation from the reclaimed site is another cost of landfilling.



The availability of materials, such as these cable wrappings collected in metal salvage operations, encourages recycling.

Incineration of waste results in a major reduction in waste volumes and landfill requirements, but involves higher costs. Opportunities for waste reduction through recycling require consideration at the plant design stage.

Legislative Requirements

In some jurisdictions aspects of recycling are mandatory. In North America this normally occurs at the municipal level where bylaws require that materials be separated by the householder and placed at the curb in a manner which facilitates collection for recycling. These programs usually rely on voluntary compliance since mandatory requirements are frequently counter-productive. Government programs may also encourage recycling through grants, subsidies, and other incentives or through educational and promotional activities.

Other legislative programs may set standards for product design, or ban certain products, such as non-refillable containers. Regulations may also set recycling requirements. For example, Ontario's new soft drink container regulations will require a mandatory 50 percent recycling rate for non-refillable beverage containers to be attained within 3 years of their introduction, otherwise deposits will be levied against specific container types.

Availability of Materials

Recycling may occur because of the availability of large quantities of suitable wastes gathered as a byproduct of other activities. For example, the establishment of the beverage container collection system in Alberta created a ready supply of scrap glass (cullet). Similarly, the Pesticide Container Collection Program has stimulated interest in utilizing the supply of plastic containers. Suitable materials may also be available in the form of process waste from other industries.

Social and Ethical Reasons

Recycling may occur because of personal convictions and concern about wasting usable items or materials. Often what is waste to one person is useful to another. The level of recycling activity depends on awareness of recycling opportunities, the cost and benefits of recycling, the level of personal inconvenience and attitudes towards waste and recycling. Social pressure, affluence, and awareness affect attitudes towards waste. Attitudes can be changed by demand for the recycled material and the amount of knowledge about recycling activities.

People recycle for ethical reasons, to reduce waste, or to support fund raising activities.

Environmental Considerations

Landfilling of materials also presents potential environmental costs. A major concern is the generation of leachate which may contaminate land, groundwater or surface water adjacent to a landfill. Other concerns include noise, dust, odor, and litter. Landfills require monitoring during operation and after closure. A leachate collection system and treatment system may be required to ensure that leachate is disposed of safely. Reduction in the use of landfills and in the amount of hazardous chemicals entering landfills would reduce this threat.

Financial Returns

For many companies the recovery and resale of secondary materials provides a profitable return on their investment. Financial incentives are not limited only to private companies that deal in recycled materials. For example, the refund offered for bottles in Alberta is available to individuals as personal income or community organizations for fund-raising.

RECYCLING ACTIVITIES AND OPPORTUNITIES

Although recycling in Alberta does not approach its full potential, a significant volume of material is recycled. Present recycling activities are discussed in detail in the background reports, but a brief summary is provided here as well as discussion of the potential for recovering materials from the waste stream and turning them into useful products or recovering the energy value.

GLASS

Almost any glass can be recycled but it should be of a similar chemical composition as the new mix to maintain its desired characteristics. There also are limits on the use of colored glass. Other colors are most easily added to green glass products.

Cullet can be used in a variety of glass products as well as in concrete, asphalt, and brick where ground glass can replace part of the sand. Cullet can be used in the manufacture of glass wool, wall panels, terrazzo, and in polymer composite sewer pipe.

In Alberta large numbers of color-sorted bottles, and subsequently large volumes of color-sorted cullet are available through the bottle depot system. Cullet is also available from beer and soft drink bottling companies and in small amounts from other suppliers. The price offered in 1984 for glass delivered to the plant ranged from $26 per ton to $54 per ton ($24 to $49 per tonne) depending on the volume and the type of shipping container.

Two Alberta companies currently use cullet: one produces containers; the other manufactures glass beads. Each year these companies use about 30,000 tonnes of cullet from non-refillable beverage containers.

About 93,400 tonnes of glass are discarded each year, of which about 52,900 tonnes are food containers. These containers are of the same basic composition as the beverage containers presently recycled through the bottle depots. Is there a feasible method of recycling this waste? Possibilities include expanding the depot system or creating a separate system to accept food containers. Community groups could be encouraged to recycle containers or curbside pickup could be supported. But are these ideas feasible? Could the present level of industrial use of cullet expand to absorb additional material? Already there is an excess of green cullet. Are there alternative industries, for example, the fibreglass industry, which might use cullet instead of manufacturing new glass for their products? These are some of the opportunities and problems that should be considered and on which the Panel would like to hear your views.

Color-sorted scrap glass (cullet) awaits cleaning and processing for reuse in new containers.

PAPER

Waste paper or secondary fibre can be separated into a number of grades that have different market values reflecting demand and value as a substitute for virgin materials. Posted prices for paper in Alberta in May 1985 ranged from $5 per ton ($4.50 per tonne) for mixed paper to $110 per ton ($100 per tonne) for computer printout.

The recovery rate for paper in Canada is low compared to many industrialized nations. Our average recovery is about 958,000 tonnes per year or 20 percent of the apparent annual domestic consumption.

Within the province several firms collect or buy secondary paper fibre. Paper is collected through drop-off bins, volunteer programs, directly from industrial, office or commercial sources, as well as through curbside collection in parts of Calgary.

The paper collected is used in Alberta for the manufacture of building products such as roofing paper and sheathing, cellulose insulation, and animal bedding. Higher grades are sent to British Columbia for use in paperboard products such as boxboard, linerboard, and corrugated cardboard. Some news grade is exported to the United States and Pacific Rim countries.

The approximately 581,000 tonnes of paper materials landfilled annually constitute the largest fraction of municipal waste. Increased recycling or use in an energy-from-waste facility would substantially reduce the volume of waste to be landfilled. Not all waste paper, however, is recoverable for use in paper products; some estimates place the recoverable amount at 60 percent of the annual new supply. But demand is for paper segregated by grade. How can the recovery rates for paper be increased especially for the desired grades of container, ledger, and computer printout? Should a new industry based on secondary fibre be encouraged to come to Alberta or should we look to the export market for the demand? Are there conflicts between the use of secondary fibre in energy from waste projects and in paper products or are the two compatible?

METALS

Published information on metal recycling in Alberta is sparse and outdated, but at least 315,000 tonnes of scrap iron are used annually in a steel mill in Edmonton to produce a variety of bar products; rounds, flats, and angles. Major generators of ferrous scrap supply dealers scrap for recycling and there is active trade in scrap metal throughout the prairie region and areas beyond. The most important sources of scrap are railways, autos, farms, and industry. Through the bottle depot system, metal beverage containers are collected, sorted and sold for recycling. Steel cans are sent to a mill in Saskatchewan; aluminum cans are baled and sold in eastern Canada. or on the export market.

Scrap from small industries, commercial and retail businesses and the domestic sector, largely remain as waste, even though local industries are short of high quality scrap and have to import it from Eastern Canada and the United States. Metals comprise about 6 percent of municipal wastes. In addition, major appliances may be collected and stored separately. Opportunities exist to recover some of this material, for example curbside collection in Ontario recovers ferrous and aluminum containers. Incinerators or energy-from-waste facilities often have ferrous metal recovery as part of the process. Is there a feasible method to improve the recovery of appliance and food container scrap in Alberta? Are there industrial sources of scrap that could be tapped? Could greater use be made of non-ferrous metals within Alberta? These types of questions must be addressed if the 109,000 tonnes of metals disposed of as waste each year are to be recycled.

PLASTICS

Alberta is a major manufacturer of polyvinyl chloride and polyethylene plastic resins. Other plastic resins and plastics are used by Alberta's plastic fabricating and processing industry. Among these are polystyrene, polypropylene, acrylonitrile-butadiene-styrene, and urethane.

Most plastic scrap produced by the fabricating and processing industry in Alberta is reportedly reused within the plant. This reuse accounts for 76 percent of scrap plastics. Of the 24 percent of the scrap that left the plant site, about seven eights was recovered by other companies for use in plastics products and one eighth was landfilled. This

Plastic beverage containers are baled and exported.

is very different from the estimated 42 percent of plastic scrap being landfilled in Ontario.

While the percentage of industrial scrap plastics that is landfilled is not large, about 85,000 tonnes are landfilled annually, including domestic and commercial sources. While mixed plastic wastes may be useful for the recovery of chemicals or energy, the key to other uses of plastic wastes lies in the segregation of the plastic resins. This can be achieved through source separation of household or commercial wastes or where plastics separation can be promoted as part of an already operating materials recovery system. Are there specific waste streams that provide untapped opportunities? Is segregation of plastic resins financially viable or should plastics be used as a fuel? What are your ideas for increasing recycling of plastics?

RUBBER

The main rubber polymers in use in Canada are natural rubber, styrene-butadiene rubber and polybutadiene rubber. These rubbers are used to form tires, tubes, wire and cable wrapping, footwear, and rug underlay or carpet backing. Car, truck, farm implement and machinery tires use about 70 percent of all rubber produced.

Tires create special landfilling problems because they do not compress, cause operating problems for the machinery used at the landfill, trap liquids and methane, and work their way to the surface after burial. Tires are sometimes stockpiled or buried in a separate landfill as in Calgary.

Rubber may be recycled in a variety of ways. Scrap can be ground and mixed with the virgin polymer or made into products such as arena flooring and rug underlay. Rubber cut from tires may be used in products such as washers, shims, sandals, and door mats. Tires may be recapped with new rubber tread. But these uses consume only a small fraction of rubber waste produced each year. One possible use for the remainder is rubber crumb in asphalt to provide improved ride and road characteristics. Crumb has been used in several highway test sections in Alberta, but the results are still being evaluated. Chemicals may also be recovered from rubber wastes, or it may be used as a fuel since rubber has a high energy content, about 27,000 kJ/kg.

Rubber is not a significant part of municipal wastes, about 0.5 percent by weight, because much of the waste produced in tires, tubes, carpet, and rug underlay is disposed of through specific service industries. However, an estimated 12,700 tonnes of tires are discarded each year in Alberta, although because of the difficulty of collection in rural areas only about half of this amount may be recoverable.

Opportunities for recycling rubber or recovering chemicals often are first sought in the use of these discarded tires. Is it practical to increase recycling of rubber in Alberta or is it enough to encourage separate collection and burial of tires for future recovery when needed? Are there technical difficulties to overcome before greater use can be made of recycled rubber?

Tires can be used in rubber products, in asphalt or as fuel.

OIL

Lubricating oils have a wide range of uses related to their properties of reducing friction and wear between moving parts. Sales in Alberta in 1983, totalled about 120 million litres. An estimated 23 million litres of used oil was collected for re-refining in 1983; a recovery rate of about 36 percent based upon the amount considered to be recoverable. Recovery rates are substantially higher in urban areas than in rural areas. Recycling of lube oil is undertaken at plants in Calgary and Edmonton. Used oil is collected by these companies or by independent operators, from industries, garages, service stations and other sources.

Recycling of used oil offers benefits such as reduction in pollution, conservation of the resource, reduction in waste management costs and creation of job opportunities. The provincial Oil Drop program seeks to capture these benefits by providing convenient locations to deposit used oil. About 20 percent of the lubricating oil sold in Alberta is now recovered for re-refining.

Much of the uncollected oil is apparently disposed of by dumping on the ground or disposal in landfills. These practices are potentially environmentally harmful as well as a waste of a reusable resource. Collection of oil for re-refining however, faces competition from uses such as road oiling, use as a fuel and farm uses. These uses are less desirable and may pose environmental problems because of the contaminants that the used oil contains.

What should be expected of individuals and industries and what should be the roles of provincial and local governments in increasing the recovery of used oil? Is increased public awareness the answer or do we require deposits, legislative restrictions or other mandatory approaches? Answers to these and other questions will help in developing policy directions for oil recycling.

PUTRESCIBLE AND YARD WASTE

Putrescible waste is a major component of municipal waste on an annual basis. During the summer and especially during spring and summer cleanup, yard waste dramatically increases and becomes a significant portion of the waste stream. No large scale composting is done in Alberta and little is known about the extent of composting by individuals. There is potential to reduce the landfilling of organic material through composting. Some questions to be answered relate to the most efficient method of utilizing this waste; should individual composting projects be encouraged or would separate collection and large scale composting be more cost effective. Is composting practical in Alberta's climate? Is the organic fraction a useful component as a fuel?

RECYCLING PATHWAYS

Although it is impossible to recycle one hundred percent of any product, several options allow recovery and reuse of some materials or energy embodied in these materials. Together these recycling pathways could divert a substantial proportion of wastes from landfilling.

The possibilities for recycling can be presented as a hierarchy based on the range of options open for using the recovered material. Material at a higher level in the hierarchy may be used in options at a lower level but not vice versa. A generalized hierarchy will be discussed, however the available options depend on the material being recycled.

Primary recycling, the first or highest level in the recycling hierarchy, is the use of the material in the same or similar products. For example, plastic trimmings from the manufacture of plastic products may be reground and reused in the moulding machines, or roll ends at paper mills can be mixed with the pulp and reused. Recycling at this level usually requires segregated, clean material, of known and uniform composition with no change or deterioration in characteristics from the primary feedstock.

Secondary recycling is the use of recovered materials in products with different properties and usually less stringent quality requirements. For example, misprinted or scrap plastic bags could be used in the manufacture of colored garbage bags, where the color masks the existing inks, but they could not be reused in clear plastic bags. Recycled newspaper can be used in paper insulation without deinking which is required to maintain brightness if the paper is to be used in printing products.

While recycling at the second stage in the hierarchy has less stringent quality requirements, the recovered material must be relatively uncontaminated by other materials and it is important that the composition of the material be known. Material used in secondary recycling processes usually would be made available through industrial scrap sources, through collection of segregated domestic wastes, or through facilities which segregate wastes for resale, for example, scrap auto processors or magnetic recovery of metals from municipal refuse.

The next level in the hierarchy, tertiary recycling, includes the recovery of usable components such as chemicals and other products from a material. For example, discarded rubber tires may be subjected to destructive distillation (pyrolysis) to produce combustible gases and oils as well as coke and carbon black. These products may be used as fuels or, in the example of carbon black, reused in manufacturing processes.

Materials used in tertiary recycling processes may be of a lower quality due to factors such as unknown or mixed composition, and other characteristics that prevent higher level recycling. Mixed waste has been used in tertiary recycling to recover combustible gases, liquids and solids.

The fourth level in the hierarchy is the incineration of materials for the recovery of energy. Incineration is the least stringent in its requirements and provides an opportunity for the recovery of resources (energy) from mixed municipal waste. Some pretreatment, such as size reduction is usually desirable.

CONSTRAINTS TO INCREASED RECYCLING

The recycling hierarchy discussed above indicates the range of options open for the recovery of useful materials from waste. Which mix of options is best for Alberta, what might be achieved and how this could happen are questions to be considered by the public hearings. The route to the future is both open and unclear.

If an increased level of recycling is desired, a number of constraints need to be overcome. The importance of a particular constraint depends on factors such as local circumstances, markets, government policies and the quantity and the quality of material. As well, the importance of different factors will depend on the intended use of a material within the recycling hierarchy. For example, quality considerations are more important in primary recycling than in the fourth level of the hierarchy (energy-from-waste).

It is beyond the scope of this report to discuss the constraints in more than general terms; additional information is contained in the detailed reports available from the Environment Council (Appendix 1). The purpose of this section is to highlight a few of the common constraints and encourage discussion about means and feasibility of overcoming them. The relevance and significance of these constraints need to be assessed by the reader and suggestions for their removal or reduction should be provided to the Panel for its consideration.

Cost of Recycled Materials Relative to Virgin or Substitute Materials

The key to the use of recycled material is its profitability. It must be financially feasible to incorporate recycled materials into a product and sell it at a price that is competitive with similar products made from virgin materials or other substitutes.

A number of factors affect the ability of recycled materials to compete in the marketplace. The abundance or concentration of natural resources in some cases means that they can be developed at lower cost than recycled materials. The capital and operating costs for collection, processing and conversion of recycled material may place limits on the uses of these materials. In some cases, the development of virgin materials may be encouraged through tax provisions and grants. In addition, a large and well-established private and public infrastructure is in place to develop, extract and utilize our natural resources.

These pesticide containers are a source of recyclable plastics but must compete with virgin plastic resins.

Local demand for recyclable materials may be hindered by the availability of less costly imports. For example, imports of secondary fiber from the Eastern United States are said to hinder paper recycling in Ontario. It is less expensive to meet demand with imports than through improvement of local supplies.

Economic instruments, for example, taxation policies, buffer stock schemes, guaranteed prices, or long-term contracts, could be used to improve the attractiveness of recycled materials. As well, subsidies and grants, and other incentives that encourage exploration for, and development of, virgin materials could be reduced or eliminated to encourage recycling.

Another alternative is the levying of product charges on materials that are not recyclable or that create disposal problems. The funds raised by these charges could help cover disposal costs, fund research aimed at improving recycling or support recycling operations. Increased costs for products which create disposal problems could shift consumer preference towards recyclable products. A variation is a litter tax applied to products such as cigarettes, snacks and packaging from fast food outlets.

Increasing tipping charges at landfills would discourage wasteful disposal habits and increase the economic viability of recycling. In Ontario, some communities offer assistance for recycling in recognition of avoided landfill costs.

The use of recycled materials may face competition from other uses for the material which are at a lower level in the hierarchy. For example the use of oil for road oiling likely has resulted in higher prices for recovered oil. While this adversely affects the economics of re-refining it stimulates the supply. The problem is to maintain a balance between the cost of collecting and re-refining used oil as compared to using virgin oil or finding a substitute.

Grants or subsidies for product development, marketing, technological research and educational programs also are means by which governments and industry could improve the competitive advantage of recycled materials. What steps do you feel are best for Alberta?

Available Quantity

Collection of sufficient quantities of a material to support an economically viable recycling operation is hampered by the relatively small and dispersed population of Alberta. The total population is 2,348,000 with about one third living outside of municipalities larger than 10,000. Collection, processing and transportation costs may be such that the return on sales of recovered materials does not support collection costs and therefore efforts are not made to develop the supply. In addition those materials that presently are recycled are those that were the most economical to access. Additional sources of materials are likely to be more dispersed, more distant from markets, more contaminated, or otherwise more costly to develop.

There may be a certain level of inexperience as well as a lack of awareness among existing or potential recycling industries of cost-effective ways of collecting, processing and marketing recyclable materials. Would an improved data base or information exchange improve the feasibility of recycling? The Alberta Waste Materials Exchange, now entering its second year, has shown some of the potential for recycling of waste products that can develop if companies become aware of the materials that are being discarded. A recycling computer "bulletin board", such as the one operating in New Jersey is another way of improving the flow of information related to recycling.

Recycling of some materials can be a viable operation even in small communities. Such efforts depend on assistance from volunteers and the community and participation by local residents. How can this assistance be generated and sustained?

High participation rates are important to the success of source separation programs for recycling municipal refuse. In some North American communities, high participation has been achieved voluntarily; in others source separation has been made mandatory. Which approach is better? Can you suggest alternatives?

There are other means by which the quantities of materials recovered might be enhanced. Deposit-refund systems encourage the return of materials. Deposit-refund systems can operate in a variety of ways and for a range of materials. The bottle return system in Alberta, for example, is financed by the consumer. Should deposit-refund systems be extended to other materials? Which materials are appropriate candidates?

Charges for waste disposal based on the amount of material disposed would increase public awareness of their disposal habits and likely increase the amount of recycling, although they might also lead to increased littering. Various schemes are in place in the United States, including one in which consumers must use special bags sold by the municipality. The costs of the bags includes waste pick-up and disposal.

Collection of sufficient quantities of materials may be a costly and time-consuming task.

Material Suitability

The demand for recyclable materials will be reduced if material cannot be supplied according to required standards. Manufacturers will substitute other materials, either maintaining the desired quality or use the recycled material in products requiring less stringent raw material quality. The severity of the quality criteria and hence the value of the recycled material will depend on the intended use.

Suitable material may be made available in two ways. Material may be collected already segregated or material may be processed after collection to provide material with the desired properties. This is in essence, the difference between source separation and post collection separation. Source separation usually is used to obtain materials suitable for the higher levels of the recycling hierarchy. Post collection separation programs rely on large scale facilities to provide large volumes of separated materials.

Source separation programs require education of the participants, willingness to participate and a high rate of participation. Whether materials are being obtained from industrial or domestic sources, participants must be given information on the types of materials to be collected and the form in which these should be provided. An incentive may be required to encourage actual participation. Often further processing is done after collection to upgrade the material to the highest possible quality and value. Nevertheless, technological constraints may prevent access by certain materials to the highest level in the recycling hierarchy. For example, it is not yet feasible to segregate domestic plastic wastes by resin type.

Technological and associated financial constraints are major hurdles facing the recovery of suitable quality material from mixed municipal wastes. Several resource recovery facilities are in operation in Canada, but have difficulty supplying materials of high and consistent quality at a reasonable price. For example, equipment to recover and color separate glass waste is not yet practical. Technological improvements that reduce costs or improve quality would improve the financial feasibility of resource recovery facilities. However, energy-from-waste facilities could form an important part of an integrated waste management system. What combination of source separation and utilization of mixed waste provides the optimum solution for Alberta?

Technological constraints also exist in incorporating recovered materials into manufacturing processes. Steps have been taken by industry, industrial associations and government agencies to resolve some of these difficulties, but improvements, particularly those which result in improved quality of recycled materials and reduced costs are still needed. What major technological advances are needed to increase recycling?

Markets

If a sufficient quantity of suitable material can be supplied to the manufacturing industry a major combination of hurdles has been overcome. However, there still remains the difficult aspect of market acceptance of goods containing secondary materials. Perceived and, at times, real inferiority in product characteristics need correction.

Products which contain recycled materials must be accepted by the consumer and compete in price and quality with products made from virgin materials. If demand for finished products containing recycled materials is low, this adversely affects demand for recycled material. What steps should be taken to enhance the use of products that contain recycled materials?

Social Constraints

Social constraints include a whole gamut of elements from ignorance of recycling opportunities to an unwillingness to use recycled materials. Social constraints are found in the attitudes and behavior of individuals, businesses, and government. Persons may support the principle of recycling but be unwilling to separate the recyclable components from household garbage. Business owners may feel that encouraging reuse of their waste materials assists competitors or unveils trade secrets. Governments may be unresponsive to demands for support of recycling programs.

These constraints represent the core of an individual's or society's attitudes. As such they are often difficult to overcome, particularly in the short term. Combinations of both extrinsic and intrinsic motivators may be needed. Extrinsic motivators are those which are received from an external source. These rewards may be monetary or non-monetary such as peer recognition for one's efforts. Intrinsic rewards are non-monetary and come from within, based on one's belief in having done a good job. This sense of personal accomplishment may be related to resource conservation, environmental protection or enhanced community spirit.

Social constraints can be tackled through education, financial support for activities such as community and local groups recycling programs, or through the use of tangible returns such as deposits and buy back campaigns. Government, industry and volunteer groups and individuals all can help. There are many programs already in place in Alberta aimed at encouraging recycling. What further steps might be taken in your community or in the Province to reduce social constraints to recycling?

Individual participation is a must in source-separation programs.

Institutional Policies

Business, education and government institutions may all undertake activities that could promote or constrain recycling. Careful attention should be paid to these activities to determine if their consequences are those that were intended.

The Beverage Container Act has resulted in the establishment of bottle depots and the collection of large amounts of materials. As a result, recycling occurs primarily because of anti-litter legislation. A government program to collect pesticide containers stimulated interest in recycling of plastics collected for reasons of environmental concern. Similarly setting aside tires in a separate location at the landfill may encourage their use as more are collected.

Legislation, policies or regulations encouraging the use of recyclable materials, raise concerns about the involvement of government in the marketplace and resultant distortion of market forces.

At a regional or local level bylaws might establish special recycling areas at landfills, require participation in curbside collection programs, set prices for landfilling at full social costs which would encourage recycling or permit diversion credits. However, these same policies improperly applied could disrupt existing recycling industries, encourage alternative disposal practices, or increase the supply of recyclable materials without a parallel increase in markets for these materials.

An area in which cooperation and coordination of policies is required is in the provision of basic data with respect to present recycling activities. Information is needed on waste generation rates and sources, present levels of recycling, costs of collection, and processing as well as import and export data. Information is needed on a national scale and at the provincial level. Improved information and communications could help make recycling activities more efficient. What are the best mechanisms for achieving these goals?

Industries and industrial associations may set policies which encourage or discourage recycling. Industrial agreements to standardize beer bottle sizes a number of years ago simplified the collection and recycling of these bottles, while recent moves to distinctive bottles have reversed these advances. Industrial associations can encourage packaging standards which facilitate recycling.

Interest has been shown by the plastics industry in the feasibility of coding plastics by resin type. Coding would improve segregation of plastics from mixed wastes and improve the recyclability of plastics.

A strong recycling industry association helps to convince the primary manufacturing industry to incorporate more secondary fibre in paper manufacture or cullet in manufactured glass. Many industries which process virgin materials also encourage recycling through actively promoting the recyclability of their products. The consumer by accepting or rejecting products also influences the future of recycling.

DIRECTIONS FOR THE FUTURE

Some of the opportunities for increasing recycling have been discussed and some of the constraints to achieving these increases identified. A wide choice of futures is available but for brevity the options can be identified as: 1. continue as we are; 2. implement mandatory recovery and reuse of all possible materials; or 3. expand recycling where feasible, appropriate and acceptable.

The first direction with its continuing dependence on landfills, means increasing problems as waste volumes increase, disposal sites decrease and people object to the establishment of new disposal facilities in their extended neighborhoods.

The second direction seems equally unacceptable. Mandatory recovery and reuse of all possible materials would cause major disruption to the economy. Product design, production technology and raw materials requirements all would require wholesale change. Nowhere has massive mandatory recovery and reuse been implemented, although some communities have mandatory source separation programs that aim for about a 20 percent reduction in materials disposed of as waste. Even this level of compulsion is in response to perceived local needs. In other locations, a contrary direction has been taken and the removal of paper from the waste stream prohibited because the waste is used as a fuel.

The third and most desirable direction is one that takes advantage of those opportunities that are feasible and available while retaining the beneficial aspects of our present system. A careful weighing of options to identify all of the costs and benefits of change is required. Unfortunately many of the costs and benefits of recycling activities cannot be measured precisely. Decisions must be best judgements based on principles, common sense, intuition and experience gained elsewhere.

The basic questions facing the Environment Council's Panel and all Albertans is what is the potential for recycling in Alberta and how do we achieve that potential? Components of an overall recycling program might include education, promotion, research, economic support or regulation.

The task that faces all Albertans; individuals, volunteer groups, industry and all levels of government is to develop from the array of possibilities, a comprehensive program for recycling in Alberta. It is in the development of this program that the Environment Council of Alberta is seeking your help. Through its Public Hearings on Recycling the Environment Council is soliciting the views of all Albertans on this matter. Your views, concerns and suggestions will assist the Council in developing its report and recommendations to the provincial Cabinet.

PUBLIC HEARINGS

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Zenith 06075 (toll free)

PUBLIC HEARINGS

ENVIRONMENT COUNCIL PUBLIC HEARINGS

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>
> *Section 7(d), The Environment Council Act.*

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PUBLIC HEARINGS

WHAT ARE ENVIRONMENT COUNCIL PUBLIC HEARINGS?

The Environment Council of Alberta (ECA) is a provincial Crown corporation set up to review, inquire into, and report to the Government on public concerns about the conservation of Alberta's environment. An important part of this mandate is achieved through the Council's public hearings. These hearings are specially arranged to offer you an opportunity to comment on specific environment conservation issues. Your views are incorporated in the report and recommendations prepared by the Council for presentation to the Government after the hearings.

PUBLIC HEARINGS

WHY SHOULD YOU PARTICIPATE?

Basic to the work of the Environment Council is the involvement of people, like you, in its activities. One of the ways for you to participate is through the Council's public hearings. By expressing your views at these hearings you can assist the Council greatly in its job of providing the best possible advice on environmental conservation issues.

HOW ARE ECA PUBLIC HEARINGS ORGANIZED?

1. ENVIRONMENTAL CONCERNS ARE EXPRESSED BY THE PUBLIC

An idea for a set of Environment Council public hearings often originates with concerns expressed by the public about a specific subject. These concerns are brought to the Government's attention by the Council and, if it agrees that legitimate concerns exist, the Government may call upon the ECA to hold public hearings on the subject.

2. AN ORDER-IN-COUNCIL IS RECEIVED

When an issue for Environment Council public hearings has been identified, terms of reference for the hearings are presented to the Council in the form of an Order-in-Council from the Government.

3. THE INFORMATION BASE IS ASSESSED

All successful public hearings feature the exchange of information. Ensuring that the public has available factual, readable, and usable background material on a hearing topic is always a primary concern of the Environment Council. If, in the Council's opinion, the information base for a public hearing is deficient, arrangements will be made for it to be developed. This work is normally done by the Council's own research staff. Other government departments or private consultants may be called upon to assist as required.

4. BACKGROUND INFORMATION IS DEVELOPED AND DISTRIBUTED

When the Council is developing its background information for a set of hearings, it is concerned about balance, and about raising issues and questions without providing pat answers. This approach is intended to stimulate public debate, and to facilitate the broad development of a variety of viewpoints, attitudes, and comments on the hearing topic. The Council's objective is to encourage diversity in the suggestions it will be receiving at the hearings.

This background material is prepared in different forms. There are summaries for those who require only a general overview on some aspect of a hearing topic. As well, there are technical reports which develop aspects more fully.

ENVIRONMENTAL CONCERNS ARE EXPRESSED
THE ORDER-IN-COUNCIL IS RECEIVED
THE INFORMATION BASE IS ASSESSED
A REPORT AND RECOMMENDATIONS ARE DEVELOPED AND DISTRIBUTED
YOUR BRIEF COMPLETES THE PICTURE
BACKGROUND INFORMATION IS DEVELOPED AND DISTRIBUTED
PUBLIC HEARINGS ARE HELD
A PANEL IS APPOINTED
INFORMATION MEETINGS ARE HELD

5. INFORMATION MEETINGS ARE HELD

Background information about the subject area of the public hearings will normally be available to the public from the Council about the time the terms of reference are issued. From then until the hearings actually begin, Council staff members are available to meet with the public to discuss the upcoming hearings and the background material. The Council also calls its own public information meetings where appropriate. At the same time, an advertising and promotion campaign to alert the public about the hearings is carried out.

6. A PANEL IS APPOINTED

The provincial government normally appoints three qualified members of the public to a panel to conduct the hearings, and to prepare a report and recommendations on the hearing topic. One member is appointed chairman, while the Chief Executive Officer of the ECA serves as vice-chairman on each panel. The panel might be appointed in the initial Order-in-Council, or in a subsequent one.

7. PUBLIC HEARINGS ARE HELD

When the public hearings take place, opinions, ideas, concerns, and expectations are gathered from the public. Hearings can be province-wide, or quite localized, depending on the issues under consideration.

Environment Council public hearings are informal. People register at our hearings on the days they are held. Most participants give a verbal presentation backed up by written material. Written briefs are appreciated, either submitted ahead of time or on the day of the hearing; however, these should be presented verbally to the panel at the hearing. Nevertheless, an "off the cuff" presentation is always welcome.

Presentations are scheduled on a first-come, first-served basis. In a relaxed atmosphere you will be invited to state and to discuss your point of view. Following that, members of the panel may wish to explore further some of the points you have outlined.

Since the Council is seriously interested in what you have to say, all presentations are recorded for later use by the panel as references. These are also available to the public as transcripts, either at the Council's offices or at a number of libraries around the province.

8. A REPORT AND RECOMMENDATIONS ARE DEVELOPED AND DISTRIBUTED

Following the hearings, the panel uses the information it has gathered, along with its own views and assessment, as the basis for its report and recommendations.

The report and recommendations are then published by the Environment Council and made available to the public, while the Government considers the advice it has received from the panel.

Finally, the panel returns to private life, and the Council begins to prepare for another set of public hearings.

HOW YOUR BRIEF COMPLETES THE PICTURE

The Environment Council seeks to provide government with comprehensive, independent, and well-founded advice on environment conservation matters. As a result, many of its recommendations from past hearings have been accepted and implemented by the Government. Future hearings can be expected to achieve similar results, and you can influence them through your participation. The impact of your views can be enhanced through the resources the Council is able to assemble in its public hearing process.

All views and information received by the panel are analyzed and then used as source material when the panel members sit down to write their final report and recommendations. Whenever anyone's views are referred to, the source is identified.

For more information about the Environment Council's public hearings, please contact the Council either by letter or telephone.

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HOW CAN YOU TAKE PART?

Public participation is the cornerstone of the activities of the Environment Council. This pamphlet has attempted to explain something about the Council. What are the ways you can work with the Council in its efforts to advise legislators about their decision-making on important environmental matters?

Public hearings cannot be held without the participation of the public, and this is where your contribution can help. You can present your point of view to the panel, and by doing so, help to ensure that the recommendations the Council makes to the Government are sound, useful, and relevant. Of course, your comments on our publications or other activities are welcome at any time.

If you require more information, please contact the Council either in writing or by telephone. A toll-free number enables any Alberta resident to contact the Council directly on any normal working day.

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Certain traditional ways exist for expressing public concerns to the decision-makers in government. With respect to the environment, however, Albertans have a unique additional way open for making their expectations and concerns known to the Alberta Government, through the Environment Council of Alberta.

WHAT IS THE ENVIRONMENT COUNCIL?

Organized as a "Crown corporation", the Council exists separately from any other government department or agency. The Council was established by an Act of the Alberta Legislature. Its main purpose is to help the Government make better decisions about environmental matters.

The Council has its own budget, financed by the Alberta Government through annual "votes" of the Legislative Assembly. With a staff of fewer than thirty people, the Environment Council is one of the smaller government agencies. Nevertheless it has a wide-ranging and responsible role of reviewing policies and programs, and inquiring into practices and proposals relating to environmental conservation in this province. The Council reports its findings to the Minister of the Environment, or in the case of public hearings, to the Minister and the Lieutenant-Governor in Council (the Cabinet).

WHAT DOES THE ENVIRONMENT COUNCIL DO?

From the views of the public, from its own research and from sources within the Government

ECA

itself, the Council gathers the information it needs to form the views and recommendations it provides to the Government. The *Environment Council Act* states that:

- The Council shall conduct an ongoing review of government policies and programs which relate to environmental conservation, and report its findings to the Environment Minister.
- When requested to do so by the Government, the Council shall hold public hearings on major environmental issues and report its recommendations to the Government.
- When an appeal is made against a "Stop Order" issued by the Environment Minister in an effort to control air or water pollution, the Council will hold a public inquiry into the matter.
- When a public hearing is required on a provincial government proposal for establishing a new wilderness area or ecological reserve, or for the addition or removal of land from an existing wilderness area or ecological reserve, that hearing shall be held by the Environment Council.
- When the Environment Minister requests it the Council shall conduct inquiries into the Minister's specific concerns on environmental matters.
- The Council is also permitted to set up a public advisory committee system, enter into contracts with people or firms having knowledge or skills necessary for its inquiries, receive information necessary for its inquiries directly from other government agencies and departments, and refer environmental conservation problems to the Department of the Environment for its report and recommendations.

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Because so much of the Council's work involves public participation, the provision of information to the public is always emphasized. For example, special publishing programs usually precede the Council's public hearings.

All Council publications are available free on request. The Council also maintains a library and reading room available to the public in its office. Besides this primary public information centre, the Council also co-operates with public libraries and other institutions across the province to provide local information centres. A list of these locations is published in the Council's annual report, and is available on request at any time from the Council.

HOW DOES THE ENVIRONMENT COUNCIL FUNCTION?

The Environment Council's Chief Executive Officer is in charge of the corporation. He speaks to the Government on behalf of the Council, and manages its operations on a day-to-day basis. Council staff is organized into three sections. Administration includes library, editorial, and support services. Research provides background information for public hearings and technical support for all Council activities. Liaison provides public relations and advertising support, handles arrangements for public hearings, and serves as the Secretariat for the Council's advisory committees.

When public hearings are proposed, special panels made up of members of the general public are selected and appointed by the Government to serve as members of the Environment Council and to conduct the hearings. Each panel serves for the duration of the specific set of public hearings for which it was appointed. Once its report and recommendations have been presented to the Government, its members return to private life. In this manner, each Environment Council panel can be tailor-made to suit the particular subject matter covered by a public hearing.

WHAT HAS THE ENVIRONMENT COUNCIL ACHIEVED?

In the last few years the Environment Council has conducted the following public hearings into major matters of environmental concern:

1978	The Environmental Effects of Forestry Operations in Alberta
1979	Water Management in the Oldman River Basin
1980	Hazardous Waste Management in Alberta
1981	Noise in Alberta
1983	Maintaining and Expanding the Agricultural Land Base in Alberta

Council members have set a high standard for providing government with comprehensive, well-founded advice on environmental conservation matters. Over time a majority of their recommendations have been accepted and implemented. As well, due to the efforts of everyone connected with the Environment Council, Albertans in every walk of life, including government service, are more aware of the need for vigilance and concern about environmental conservation. Some people have obtained information from the Council. Others have participated in public hearings or other aspects of the Council's information- and opinion-gathering processes. Many others have learned something about an environmental issue through news coverage of Environment Council of Alberta activities.

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APPENDIX 1

BACKGROUND REPORTS

Environment Council of Alberta. Bibliography of Recycling. In preparation.

Free, B. 1985. Municipal Solid Waste - Alberta's Untapped Resource?

Free, B. 1986. A Social Perspective of Recycling in Alberta.

Lilley, J. 1985. Resource Recycling in Alberta.

Lilley, J. 1985. Garbage or Gold? Issues and Opportunities: Terms of Reference and Background Information.

Rogers, T. Legislation, Policies and Programs Affecting Recycling in Alberta. In preparation.

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